Table 6.8. Estimates of the price elasticity of cigarette demand for adults from individual-level data

Study	Estimated price elasticities	Comments
Lewit and Coate 1982	-0.42	1976 National Health Interview Survey; ordinary least squares methods; elasticities by age and sex.
Mullahy 1985	-0.47	1979 National Health Interview Survey; instrumental variables and probit methods; detailed modeling of addiction; elasticities by sex.
Chaloupka 1990	-0.60 (men) not statistically different from zero (women)	Second National Health and Nutrition Examination Survey, 1976–1980; instrumental variables methods; detailed modeling of addiction; elasticities by sex.
Chaloupka 1991 and 1992	-0.27 to -0.48	Second National Health and Nutrition Examination Survey, 1976–1980; instrumental variables methods; detailed modeling of addiction; elasticities by age and educational attainment.
Wasserman et al. 1991	0.069 (1970) -0.23 (1988)	1970, 1974, 1976, 1979, 1980, 1983, and 1985 National Health Interview Surveys; generalized least squares and two-part methods; allow changes in elasticity over time.
Hu et al. 1995a	-0.46	California Behavioural Risk Factor Surveys, 1985–1991; two-part methods; controls for interdependence of other behavioral risk factors and smoking.
Ohsfeldt et al. 1997	-0.05 (tax elasticity, males)	1985 Current Population Survey, males aged 16 years and older; treats taxes and control policies as endogenous; elasticity estimates for prevalence only.
Centers for Disease Control and Prevention 1998	-0.25 (full sample) -0.14 (whites) -0.32 (blacks) -1.89 (Hispanics) -0.29 (at or below median income) -0.17 (above median income) -0.26 (men) -0.19 (women)	1976–1980, 1982, 1985, 1987–1992 National Health Interview Surveys; two-part methods.
Evans and Ringel 1999	-0.25 to -0.56	Natality Detail data, 1989–1992, pregnant women; two-part models.
Ohsfeldt et al. 1999	-0.15 (tax elasticity, males)	1992/93 Current Population Survey, males aged 16 years and older; treats taxes and control policies as endogenous; elasticity estimates for prevalence only.

the full sample but also for subsamples based on age (20–25 years, 26–35 years, and 36–74 years) and sex. Price had a greater impact on whether a respondent smoked at all than on how many cigarettes a respondent smoked. The estimated elasticity of demand for smoking prevalence was -0.26 for the full sample, and the total price elasticity of demand was -0.42. The effects of price were larger for younger persons: the total estimated price elasticity for persons 20–25 years old was approximately double that for persons 26–74 years old. The study also found that men, particularly those aged 20–35 years, were quite responsive to changes in cigarette prices, whereas women were almost unaffected by price.

These findings regarding age are substantiated as well by Lewit and colleagues (1981), who used data from Cycle III of the Health Examination Survey (1966–1970) to examine the impact that prices and the antismoking advertisements broadcast under the Fairness Doctrine had on cigarette smoking among 6,768 adolescents (12–17 years old). Using the same basic methods employed in the study by Lewit and Coate (1982), this analysis estimated that the impact of price on adolescent smoking (measured at a total price elasticity of -1.44) was about three times that for adult smoking (Lewit and Coate 1982). The study by Lewit and colleagues (1981) also confirmed that price had a greater impact on the decision to smoke (elasticity of -1.20) than on the average quantity of cigarettes consumed by smokers (elasticity of -0.25). These findings were generally supported by another analysis of data from the 1974, 1976, 1977, and 1979 National Household Surveys on Drug Abuse (Grossman et al. 1983).

Mullahy (1985) was the first to estimate cigarette demand on the basis of a theoretical and empirical model treating cigarette smoking as an addictive behavior. This model implied that a person's smoking decisions at any point in time are dependent on that person's smoking history. However, unlike most of the more recent econometric applications of addictive behavior, this analysis assumed that individuals behave myopically—that is, they ignore the future consequences of their cigarette addiction when making current smoking decisions. Using data on 13,794 persons who participated in the 1979 National Health Interview Survey, Mullahy (1985) estimated smoking prevalence and average cigarette consumption separately for men and women (aged 17 years and older). In finding that a person's past cigarette smoking had a significant impact on current smoking decisions, the analysis supports the hypothesis that cigarette smoking is an addictive behavior. The study also found that both smoking prevalence and average cigarette consumption were inversely related to cigarette prices. Finally, Mullahy estimated that men were somewhat more responsive to price than women (total price elasticities of demand were -0.56 and -0.39, respectively).

Wasserman and colleagues (1991) used data from several of the National Health Interview Surveys from the 1970s and 1980s to consider how the price sensitivity of cigarette demand changed over time. Using a generalized linear model, the investigators concluded that cigarette demand has become more responsive to price over time. In the earlier years of their sample, they found that increased cigarette prices did not reduce cigarette smoking. However, they estimated that, beginning in 1985, when the overall price elasticity of cigarette demand was -0.23, increases in cigarette prices would reduce smoking. As part of the same study, these investigators used data on 1,891 youth aged 12–17 years who had participated in the Second National Health and Nutrition Examination Survey (1976–1980). Unlike Lewit and colleagues (1981), Wasserman and colleagues (1991) found that the estimated price elasticity for youth was not statistically different from that for adults. Indeed, the estimated effects of price on youth smoking were not statistically different from zero in any of the models. The investigators attributed their relatively low estimates of the price elasticity of demand to their including in their demand equations an index that controlled for smoking restrictions. This index, which was highly correlated with price, had a negative significant effect on smoking (particularly on young people's decision to smoke). Wasserman and colleagues argued that because of the high correlation between the index and cigarette prices, excluding this index would lead to biased estimates of the effect of prices on demand. Indeed, when they excluded the index from their estimated equations, their estimated price elasticities were comparable to those from other studies.

Chaloupka (1990, 1991, 1992) used data from the Second National Health and Nutrition Examination Survey (1976–1980) in applying the Becker and Murphy (1988) model of rational addiction to cigarette smoking. The assumption of rational (or nonmyopic) addictive behavior implies that individuals consider, to some degree, the future consequences of their current smoking decisions (which depend on past choices). Chaloupka's estimates supported the hypotheses that smoking is an addictive behavior and that the future consequences of this addiction are an important determinant of current cigarette smoking. Moreover, the estimated long-run price elasticity of demand (in the range of -0.27 to -0.48) was well above that obtained when the addictive aspects of cigarette

Table 6.9. Estimates of the price elasticity of cigarette demand for youth and young adults from individual-level data

Study	Estimated price elasticities				Comments
	Prevalence	Quantity	Total		
Lewit et al. 1981	−1.20	−0.25	−1.44		Health Examination Survey, Cycle III, 1966–1970; ordinary least squares methods for consumption and smoking participation; aged 12–17 years.
Lewit and Coate 1982	−0.74	−0.20	−0.89		1976 National Health Interview Survey; ordinary least squares methods; elasticities by age and sex; aged 20–25 years.
Grossman et al. 1983	0.88	−1.55	−0.67	(1974)	National Household Surveys on Drug Abuse, 1974, 1976, 1977, and 1979; least squares methods; aged 12–17 years.
	−0.62	0.11	−0.51	(1976)	
	−0.93	0.91	−0.02	(1977)	
	−0.89	0.73	−0.16	(1979)	
Chaloupka 1991	Not statistically different from zero				Second National Health and Nutrition Examination Survey, 1976–1980; instrumental variables methods; detailed modeling of addiction; aged 17–24 years.
Wasserman et al. 1991	Not statistically different from adults (generalized linear modeling); not statistically different from zero (two-part model)				Second National Health and Nutrition Examination Survey, 1976–1980; generalized (iterative weighted) least squares and two-part methods; aged 12–17 years.
Douglas and Hariharan 1994	No significant effect of prices on smoking initiation decisions				1988 and 1989 National Health Interview Surveys; hazard models of smoking initiation; detailed modeling of addiction.
Chaloupka and Grossman 1996	−0.675	−0.638	−1.313		1992, 1993, and 1994 Monitoring the Future surveys of 8th, 10th, and 12th graders; two-part methods; mostly aged 12–18 years.
Chaloupka and Wechsler 1997	−0.53	−0.58	−1.11		1993 Harvard College Alcohol Study; two-part methods; college students mostly aged 18–22 years.
Chaloupka et al. 1997	−0.43	−0.16	−0.59		1992, 1993, and 1994 Monitoring the Future surveys of 8th, 10th, and 12th graders; smokeless tobacco use by young males; two-part methods; mostly aged 12–18 years.

Table 6.9. Continued

Study	Estimated price elasticities			Comments
	Prevalence	Quantity	Total	
Lewit et al. 1997	–0.87 (prevalence) –0.95 (intentions)			1990 and 1992 data from COMMIT* sites; 9th graders.
Centers for Disease Control and Prevention 1998	–0.37	–0.21	–0.58	1976–1980, 1982, 1985, 1987–1992 National Health Interview Surveys; two-part methods; aged 18–24 years.
Douglas 1998	No significant effects of prices on smoking initiation decisions; elasticity of approximately –1.0 for duration of smoking			1987 National Health Interview Survey; hazard models of smoking initiation and cessation; detailed modeling of addiction.
DeCicca et al., unpublished data, April 1998	–1.32 (8th grade) –0.95 (10th grade) –0.71 (12th grade) –0.03 (smoking onset, 8th to 12th grade)			1988 National Education Longitudinal Survey; treats each wave independently for prevalence; longitudinal data used to estimate effect of price on smoking onset.
DeCicca et al., unpublished data, August 1998	–1.994 to –0.746 (8th grade) –1.230 to –0.660 (10th grade) –0.982 to –0.274 (12th grade) –0.505 to –0.025 (smoking onset, 8th to 12th grade)			1998 National Education Longitudinal Survey; treats each wave independently for prevalence; longitudinal data used to estimate effect of price on smoking onset.
Dee and Evans, unpublished data, 1998	–2.19 to –2.01 (8th grade) –1.15 to –0.94 (12th grade) –0.79 to –0.63 (smoking onset, 8th to 12th grade)			Re-analysis of DeCicca et al. April 1998 data with same methods; differences in sample construction and variable definitions.
Evans and Huang, unpublished data, 1998	–0.20 (1977–1992) –0.50 (1985–1992)			1977–1992 Monitoring the Future surveys; high school seniors; state-aggregated prevalence rates; allow for state effects and state-specific time trends.
Chaloupka and Pacula 1999	–0.928 (men) –0.595 (women) –0.639 (whites) –1.108 (African Americans)			1992, 1993, and 1994 Monitoring the Future surveys of 8th, 10th, and 12th graders; prevalence only; mostly aged 12–18 years.

*COMMIT = Community Intervention Trial for Smoking Cessation.

Table 6.9. Continued

Study	Estimated price elasticities			Comments
	Prevalence	Quantity	Total	
Harris and Chan 1999	−0.831	−0.165	−0.996	1992–1993 Current Population Survey; two-part methods; also considered differential effects of premium and discount brand prices.
	(aged 15–17 years)			
	−0.524	−0.255	−0.779	
	(aged 18–20 years)			
	−0.370	−0.274	−0.644	
	(aged 21–23 years)			
	−0.202	−0.455	−0.657	
	(aged 24–26 years)			
	−0.095	−0.234	−0.329	
	(aged 27–29 years)			
Tauras 1999	0.269 to 0.466 price elasticity of cessation			Monitoring the Future survey longitudinal data; young adults; multiple failure duration analysis; parametric and semi-parametric models.
Tauras and Chaloupka 1999b	−0.121	−0.67	−0.791	Monitoring the Future longitudinal data formed from high school senior surveys for 1976–1993; mostly aged 18–32 years.
Gruber 2000	−0.666	−0.059 (older teens, Monitoring the Future surveys)		1991–1997 Monitoring the Future surveys of 8th, 10th, and 12th graders; 1991, 1993, 1995, and 1997 Youth Risk Behavior Surveys; 1991–1997 Vital Statistics Natality Detail files for teens giving birth before age 19; two-part models; state and year fixed effects.
	−0.210	−0.003 (younger teens, Monitoring the Future surveys)		
	−0.311	−0.029 (all teens, Monitoring the Future surveys)		
	−1.534	−1.576 (older teens, Youth Risk Behavior Survey)		
	0.419	−0.227 (younger teens, Youth Risk Behavior Survey)		
	−0.126	−0.526 (all teens, Youth Risk Behavior Survey)		
	−0.376	−0.145 (older teens, Natality Detail files)		
	−0.240	−0.058 (younger teens, Natality Detail files)		
	−0.353	−0.124 (all teens, Natality Detail files)		

smoking were ignored. Furthermore, these estimates of the price responsiveness of demand were not sensitive to the inclusion of variables reflecting smoking restrictions. Chaloupka (1990, 1991, 1992) found that young adults were not responsive to changes in cigarette prices (in contrast to the findings of Lewit and Coate [1982]) and that men and less-educated persons were much more responsive to changes in cigarette prices than were women and more-educated persons.

Douglas and Hariharan (1994) applied ideas from Becker and Murphy's (1988) economic model of addiction to look at smoking initiation decisions. Using data from the 1978 and 1979 smoking supplements to the National Health Interview Survey, Douglas and Hariharan estimated a parametric duration model that accounted for observed patterns of smoking initiation: the "hazard" of smoking initiation rises sharply from ages 12 through 20 and then declines dramatically, with initiation being unlikely after age 25. On the basis of this model, the analysis found that increases in cigarette prices had no impact on teenagers' decisions to begin smoking. Douglas (1998) extended this work by estimating a model of the hazards of smoking initiation and cessation using data from the cancer risk factor supplement to the 1987 National Health Interview Survey. Douglas also finds little empirical evidence that higher cigarette prices would reduce smoking initiation. However, the investigators noted that their estimated price effects were likely to be biased downward because of problems with the measurement of the price variables they employed. Douglas did find, however, that increases in cigarette prices significantly increase the likelihood of smoking cessation, concluding that a 10-percent increase in price would reduce the duration of smoking by approximately 10 percent.

More recent work by Tauras confirms the findings that higher cigarette prices induce smoking cessation (Tauras 1999; Tauras and Chaloupka 1999a). Using the longitudinal data on young adults from the Monitoring the Future project, Tauras (1999) estimated parametric and semi-parametric duration models that allow for multiple cessation attempts by young adult smokers. His estimates indicate that the likelihood of an initial cessation attempt and the probabilities of subsequent attempts rise as cigarette prices rise, with an average price elasticity of cessation of 0.343. In a somewhat less sophisticated analysis using the same data that examined the potential for gender differences in the effects of price on cessation, Tauras and Chaloupka (1999b) concluded that the likelihood of smoking cessation among both young adult men and young adult women rises significantly as cigarette prices rise.

Hu and colleagues (1995a) used data from the 1985–1991 California Behavior Risk Factor Surveys to estimate smoking prevalence and average cigarette consumption through equations that accounted for the interdependence of smoking and other behavioral risk factors. Using two-part methods, Hu and colleagues found that their estimates of the price elasticity of smoking prevalence were significantly lower when allowing for the interdependence of smoking and other behavioral risk factors (such as drinking and obesity), whereas their estimates of the effect of price on average cigarette consumption by smokers were unaffected. The analysis estimated that the price elasticity of demand was –0.46 overall, –0.24 for smoking prevalence, and –0.22 for cigarette consumption.

More recently, data from the 1976–1980, 1983, 1985, and 1987–1992 National Health Interview Surveys have been used to study the effects of prices on smoking among adults (CDC 1998). Researchers found that both the probability of smoking and the average cigarette consumption among smokers were inversely related to cigarette prices, with an overall estimated price elasticity of demand of –0.25. In addition, they found significant differences in price responsiveness for various subpopulations, including those defined by race/ethnicity, age, family income, and gender. They found that blacks are twice as responsive as whites to changes in cigarette prices and that Hispanics are even more price sensitive. Similarly, the researchers' estimated price elasticity of –0.58 for young adults (aged 18–24 years) is well above that estimated for the full sample, whereas individuals with family incomes at or below the sample median were about 70 percent more responsive to price than those with higher family incomes. Finally, they found that men are much more price responsive than women.

To determine whether smokers engage in any form of compensating behavior in response to higher cigarette taxes, Evans and Farrelly (1998) focused on the data from the 1979 Smoking and 1987 Cancer Control Supplements to the National Health Interview Survey. These supplements were unique in that they collected information on the brand of cigarettes smoked. This information was converted into detailed data on tar and nicotine content, length of cigarette, and type of filter. The investigators found that continuing smokers engage in compensating behavior in response to higher cigarette taxes. That is, they found that smokers in high-tax states were more likely than smokers in low-tax states to smoke higher-tar and higher-nicotine cigarettes as well as longer cigarettes. This compensating behavior by continuing smokers left their average daily tar and nicotine intake unchanged. Moreover,

younger smokers were much more likely to engage in this compensating behavior, so much so that the higher taxes led to an increase in average daily tar and nicotine intake among continuing young adult smokers.

Recent research by Chaloupka and colleagues focused on the price responsiveness of cigarette smoking among adolescents and young adults. Chaloupka and Wechsler (1997) used 1993 data from 16,277 students in 140 U.S. colleges and universities to estimate the price elasticity of cigarette smoking among young adults. Using two-part methods, the investigators separately estimated the effects of prices on smoking prevalence and on average consumption among smokers after controlling for restrictions on cigarette smoking and limits on youth access to tobacco. College students, who were mostly aged 18–22 years, were very responsive to changes in cigarette prices. The estimated price elasticity of smoking prevalence in this population was –0.53, and the elasticity for average cigarette consumption was –0.58, for an overall price elasticity of demand of –1.11.

Chaloupka and Grossman (1996) employed similar methods to examine cigarette smoking among more than 110,000 young people participating in the 1992, 1993, and 1994 Monitoring the Future surveys of 8th-, 10th-, and 12th-grade students. Like several other researchers, Chaloupka and Grossman found that smoking by younger persons is very responsive to changes in cigarette prices. Their estimated elasticity of smoking prevalence for this sample of mostly 12- through 18-year-olds was –0.675, with an overall estimated price elasticity of demand centered on –1.313. Chaloupka and Pacula (1999) used these data to look at the differential response by gender and race, concluding that young men and young African Americans are more responsive to price than young women and young whites.

Most recently, Tauras and Chaloupka (John A. Tauras and Frank J. Chaloupka. Price, clean indoor air laws, and cigarette smoking: evidence from longitudinal data for young adults, unpublished data, July 1, 1998) used data from the longitudinal component of the Monitoring the Future surveys to estimate the effects of price on young adult smoking. Using 35 panels formed from the 1976 through 1993 high school senior surveys, they estimated models controlling for unobserved state and individual factors affecting cigarette demand. For their sample of young adults, mostly aged 18–32, Tauras and Chaloupka estimated an overall price elasticity of demand centered on –0.79. Taken together, these estimates imply that increases in cigarette prices would lead to relatively large reductions in smoking among adolescents and young adults.

This conclusion is supported by recent studies by Lewit and colleagues (1997) and Evans and Huang (William N. Evans and Lynn X. Huang, Cigarette taxes and teen smoking: new evidence from panels of repeated cross-sections, unpublished data, April 15, 1998; Harris and Chan 1999; Gruber 2000). Lewit and colleagues used data for ninth-grade students in 1990 and 1992 collected in the 22 North American communities from the Community Intervention Trial for Smoking Cessation (COMMIT). They found that both youth smoking prevalence and youth intentions to smoke are inversely related to cigarette prices, with estimated price elasticities of –0.87 and –0.95, respectively. Evans and Huang estimated a somewhat smaller effect of –0.20 for high school seniors by using annual, state-level measures of smoking prevalence aggregated from the 1977 through 1992 Monitoring the Future surveys. However, they concluded that this had increased over time, estimating an elasticity of –0.50 for the period from 1985 through 1992. Harris and Chan (1999), using data from the 1992–1993 Tobacco Use Supplement to the Current Population Survey, provide consistent evidence that price responsiveness falls with age. Their estimated elasticities range from –0.996 for 15- to 17-year-olds to –0.329 for 27- to 29-year-olds. Gruber (2000) reaches a somewhat different conclusion using data from the 1991 through 1997 Monitoring the Future surveys, the 1991, 1993, 1995, and 1997 Youth Risk Behavior Surveys, and the 1991 through 1997 Vital Statistics Natality Detail files for teens giving birth before their 19th birthday. His estimates indicate that older teens are relatively more responsive to price than younger teens (approximately 17 to 18 years of age compared with approximately 13 to 16 years of age). His estimated price elasticity of smoking prevalence for older teens centers on –0.67, while he finds that younger teens, on average, are not sensitive to price. In addition, he concludes that price sensitivity among older teens is greatest for more socioeconomically disadvantaged groups, such as young blacks or those with less educated parents.

In contrast, DeCicca and colleagues (Philip DeCicca, Donald Kenkel, and Alan Mathios, Putting out the fires: will higher taxes reduce youth smoking? unpublished data, April 1998) concluded that higher cigarette taxes have a very small impact on smoking initiation among youth. Using data from the 1988, 1990, and 1992 waves of the National Education Longitudinal Study (NELS) of 1988, and treating each wave separately, the investigators estimated price elasticities for youth smoking prevalence comparable to those discussed above. However, when they used the longitudinal data to examine the onset of daily smoking

between 8th and 12th grade among youth not smoking in 8th grade, DeCicca and colleagues found little effect of price. In a separate analysis of the same data, Dee and Evans (Thomas S. Dee and William N. Evans, A comment on DeCicca, Kenkel, and Mathios, unpublished data, May 10, 1998) come to the opposite conclusion. Dee and Evans made two adjustments to the construction of the sample used by DeCicca and colleagues—including respondents with missing data on some covariates (about 20 percent of the sample) and redefining several variables based on the categorical data. After making these changes, Dee and Evans estimated a price elasticity for the onset of smoking of -0.63, consistent with several of the other recent studies of youth smoking based on cross-sectional data.

In response to Dee and Evans, DeCicca and colleagues (Philip DeCicca, Donald Kenkel, and Alan Mathios, Putting out the fires: will higher taxes reduce youth smoking?, unpublished data, August 1998) conducted a reanalysis of NELS data by using an alternative approach to dealing with the problem of missing data. Their reanalysis produced somewhat more significant estimates for the effect of cigarette taxes on the onset of daily smoking between 8th and 12th grade; the implied price elasticities from alternative specifications ranged from -0.025 to -0.505. However, smaller, less significant effects are found for models that employ cigarette prices. After obtaining separate estimates based on race and ethnicity, DeCicca and colleagues concluded that higher cigarette taxes have little impact on smoking onset by black and white youth but significantly reduce onset among Hispanic youth and youth of other races. The use of longitudinal data to research the impact of cigarette tax and price changes on smoking initiation is clearly an important and appropriate step. The differing conclusions from earlier studies of the same data suggest, however, that these discordant results should be weighed cautiously against the prevailing findings of recent studies.

Finally, two recent studies by Ohsfeldt and colleagues (1997, 1999) examined the impact of cigarette and other tobacco taxes on the probabilities of cigarette and smokeless tobacco use by males 16 years of age and older using data from the 1985 and 1992/1993 Current Population Surveys. To account for the potential reverse causality between demand and tobacco control policies (including taxes), the researchers estimate a simultaneous equations model. They find consistent evidence that higher cigarette taxes reduce the probability of smoking.

Behavioral Economics Studies of Cigarette Demand

Behavioral economics is the relatively new application of the principles of consumer demand theory to experimental psychology (Hursh and Bauman 1987). In a laboratory setting, behavioral economists studying addiction-related behaviors focus on the impact of unit price on drug dependence, including nicotine dependence. Price, in this literature, is defined as the response required to receive one dose of the drug (Bickel et al. 1993; Bickel and Madden 1999). As in standard economic theory, a key prediction of this branch of behavioral economics is that drug consumption is inversely related to price. One advantage of this experimental approach in the analysis of cigarette demand is that it allows researchers to study the effects of differences in cigarette prices that are many times larger than the price differences observed in cross-sectional data, time series data, or both. One limitation, however, is that these methods are generally applicable only to dependent individuals. Thus, for example, they do not pertain to initiation.

In a series of papers, Bickel, DeGrandpre, and their colleagues reported the results of research on cigarette smoking in their behavioral economics laboratory (Bickel et al. 1991, 1992; DeGrandpre et al. 1992, 1994; Bickel and DeGrandpre 1996). In the experiments, nicotine-dependent smokers were rewarded with two puffs on a cigarette after the completion of a specified number of responses. The total number of puffs received is the measure of consumption, and the number of responses required is the measure of price. The number of responses required to receive two puffs varied from 100 to 3,200, thereby allowing the researchers to study the impact of price on demand over a large range of prices. As in the econometric and other studies described previously, this experimental approach found an inverse relationship between cigarette smoking and price. More interesting, however, is the nature of the relationship between price and consumption. The investigators found that the price elasticity of demand rose as price rose. That is, the percentage reduction in consumption for a given percentage rise in price was larger at higher prices.

Studies of Smokeless Tobacco Use and Price

Although numerous studies have examined the impact of cigarette prices and smoking prevention policies on cigarette smoking, relatively few studies

have examined the corresponding issues for smokeless tobacco use, and virtually none consider such use in diverse culture groups. Similarly, few analyses have examined the possible substitution of smokeless tobacco products or cigarettes in response to changes in their relative prices.

Ohsfeldt and colleagues begin to address these gaps in the literature in two studies of smokeless tobacco use (Ohsfeldt and Boyle 1994; Ohsfeldt et al. 1997, 1999). Using state-level data for males aged 16 years and older who had participated in the September 1985 Current Population Survey, Ohsfeldt and Boyle examined the impact of various tobacco taxes on the prevalence of smokeless tobacco use. Their analysis, which controlled for other determinants of demand, found that higher taxes on smokeless tobacco were associated with lower use of smokeless tobacco. The prevalence of smokeless tobacco use, however, was positively related to cigarette excise taxes. The investigators suggested that these findings might partly explain the growth in smokeless tobacco use among young males during the 1980s. During this period, when cigarette excise taxes were rising more rapidly than smokeless tobacco taxes, comparatively larger increases occurred in cigarette prices. As the research previously described indicates, increases in cigarette prices significantly reduce cigarette smoking. Ohsfeldt and Boyle's analysis, however, suggested that tobacco use overall might not be significantly reduced, because some smokers might turn to using the comparatively less expensive smokeless tobacco products. These findings were generally confirmed by the analysis by Ohsfeldt and colleagues (1997) of the individual-level data from the September 1985 Current Population Survey and their subsequent analysis of data from the September 1992, January 1993, and May 1993 surveys (Ohsfeldt et al. 1999). The authors concluded that higher smokeless tobacco taxes reduce the probability of smokeless tobacco use but that higher cigarette taxes, while reducing the probability of smoking, increase the likelihood of smokeless tobacco use.

Similarly, using data on young males from the 1992, 1993, and 1994 Monitoring the Future surveys of 8th-, 10th-, and 12th-grade students, Chaloupka and colleagues (1997) concluded that both the prevalence and the frequency of smokeless tobacco use are inversely related to its price. They estimated an overall price elasticity of smokeless tobacco demand by young males of –0.59, with more than two-thirds of the effect on the prevalence of smokeless tobacco use.

Cigarette Prices and Other Substance Use

Little is known about the relationships between cigarette prices and other substance use, whereas much is known about the impact of cigarette price on smoking. Economists define two goods as complements if an increase in the price of one good reduces the consumption of not only that good but also the consumption of the other. Conversely, substitutes are goods for which an increase in the price of one results in an increase in the consumption of the other. A few very recent econometric studies have examined the relationship between cigarette prices and other substance use (Pacula 1998a,b; Chaloupka et al. 1999; Farrelly et al. 1999; Pacula et al. 2000).

Research on patterns of substance use among youth generally concludes that youth begin with tobacco, or alcohol, or both and that some youth progress to marijuana and other illicit drug use (Kandel 1975; Kandel and Yamaguchi 1993; USDHHS 1994). Other research concludes that cigarette smoking is a significant predictor of both the probability and the frequency of other drug use (USDHHS 1988; Henningfield et al. 1990). This research suggests that cigarettes and other substances are complements for one another and that higher cigarette prices, by discouraging smoking among youth, could significantly reduce youth and adult drinking and illicit drug use.

Pacula (1998a), in the first econometric examination of this "gateway hypothesis," used data from the National Longitudinal Survey of Youth to examine the impact of cigarette prices in earlier years on current marijuana use by young adults. Her estimates are consistent with the gateway hypothesis; that is, higher past cigarette prices (which are expected to reduce past cigarette smoking) reduce the likelihood that a young adult currently uses marijuana. However, she finds no relationship between contemporaneous cigarette prices and marijuana use (Pacula 1998b). Chaloupka and colleagues (1999) used data from the 1992 through 1994 Monitoring the Future surveys of 8th-, 10th-, and 12th grade students to examine the relationship between current cigarette prices and current cigarette smoking and marijuana use. They found that higher cigarette prices, in addition to reducing current cigarette smoking, also reduce current marijuana use. Farrelly and colleagues (1999) found similar evidence for adults using several of the recent National Household Surveys on Drug Abuse. In addition, they found that higher cigarette prices reduced alcohol use. More recently, using a longer time series of data from the Monitoring the Future surveys of 12th-grade students Pacula and colleagues (2000) found little impact c

cigarette taxes on youth marijuana use. The growing evidence suggests that cigarettes and marijuana are not substitutes for one another, implying that higher cigarette prices will not lead to increased marijuana use, with several studies implying the opposite—that higher cigarette prices will reduce both cigarette and marijuana smoking. Much more research is needed, however, to firmly establish these relationships.

Discussion

A few general conclusions can be drawn from these studies of the effects of cigarette prices on smoking. First, increases in cigarette prices lead to significant reductions in cigarette smoking; most studies, using a wide variety of data and methods with various strengths and weaknesses, predict that a 10-percent increase in price will reduce overall cigarette consumption by 3–5 percent. Second, the effects of increases in cigarette prices are not limited to reductions in average cigarette consumption among smokers but include significant reductions in smoking prevalence. These effects on smoking prevalence constitute both an increase in smoking cessation among smokers and a reduction in smoking initiation among potential young smokers. Third, although evidence concerning the effects of prices on adolescent smoking is mixed, the majority of the evidence from recent studies indicates that adolescents and young adults are significantly more responsive than adults to changes in cigarette prices. Most recent studies found that adolescents and young adults were two to three times more sensitive than adults to price. Ongoing research, particularly that based on longitudinal data, will help clarify this issue. Finally, the limited number of studies of smokeless tobacco use suggest that increases in smokeless tobacco prices would reduce the prevalence of smokeless tobacco use.

Taxation of Tobacco Products

As the preceding section indicates, numerous studies of the demand for cigarettes confirm a fundamental principle of economics: increased tobacco prices will reduce tobacco use. In general, several factors will determine the retail prices of cigarettes and other tobacco products. For example, factors that reduce the supply of tobacco will raise the prices of tobacco products. As described previously, these factors include tobacco price support programs, market power and collusive behavior among firms in the markets for tobacco products, and restrictions on trade in tobacco and tobacco products. The most important policy-related determinants of prices, however, are taxes on tobacco products.

In the United States, tobacco is taxed in various ways by the federal, state, and local governments. The most important of these are the excise, or per unit, taxes imposed on cigarettes and the general sales tax (an ad valorem tax) applied to cigarettes and other tobacco products in most states. Ad valorem taxes are a fixed percentage of the price and thereby increase or decrease as price changes. Excise taxes, on the other hand, do not change over time with prices.

Tobacco taxes have relatively low administrative costs and can generate substantial revenues. In recent years, increased taxation of tobacco products has been used as a strategy to reduce tobacco consumption and thereby to improve public health. For example, the health benefits of tax-induced reductions in smoking were often cited by supporters of the federal cigarette excise tax proposed as part of the Clinton administration's proposed Health Security Act of 1993, which included an increase of 75 cents per pack. (The act did not pass.) Similarly, anticipated large reductions in youth smoking were, in part, the rationale for tax increases of up to $2.00 per pack proposed as part of most proposals for national tobacco legislation and the average $2.00 state and federal tax set as a goal for 2010 by the Healthy People 2010 initiative. The health benefits of higher taxes were also the focus of the large voter-initiated tax increases in Arizona, California, Massachusetts, Michigan, and Oregon, as well as the large legislated tax increases in Alaska, Maine, and elsewhere.

Rationales for Tobacco Taxation

Alternative approaches have been used to determine the appropriate level of cigarette and other tobacco taxes. One such approach is the historical or comparative standard, which looks at the relative value of these taxes over time or cross-sectionally. A second approach is to use an efficiency standard based on the external costs of smoking; this approach implies that tobacco taxes can be thought of as "user fees" sufficient to cover the external costs of tobacco use. This approach, however, raises questions concerning the fairness of such taxes. A further argument has been made for substantial increases in tobacco taxes, because these tax hikes would lead to substantial reductions in the morbidity and mortality associated with cigarette smoking. Finally, because taxes on cigarettes and other tobacco products are a relatively simple way to generate revenues, it has been suggested that these taxes can be set at levels that maximize their returns. Each of these alternatives will be discussed.

Historical or Comparative Standard

Federal Tobacco Taxes

Tobacco has been taxed in North America since the British government first imposed taxes during colonial times. Beginning in 1794, the U.S. government imposed tobacco taxes that periodically rose with revenue needs and subsequently fell because of consumer opposition. Since 1864, when cigarette and other tobacco taxes were included in a package to finance the Civil War, taxes on tobacco in one form or another have remained a part of the federal tax system. Taxes continued to rise and fall over the next 87 years, generally increasing with revenue needs during the Spanish-American War, World Wars I and II, and the Korean War (Table 6.10). The final war-related increase in the federal excise tax per pack of cigarettes was from 7.0 cents to 8.0 cents per pack on November 1, 1951, where it remained for the next three decades.

The most recent federal tax increases were motivated by a need to raise revenues for a different purpose—to reduce the increasing federal budget deficit. The first of these hikes in the federal cigarette excise tax came as part of the Tax Equity and Fiscal Responsibility Act of 1982 (Public Law 97-248), which temporarily doubled the per pack tax to 16.0 cents, effective January 1, 1983. The tax was to revert to 8 cents on October 1, 1985, but after several extensions, the 16-cent tax was made permanent in 1986. As the result of two 4-cent increases included in the Omnibus Budget Reconciliation Act of 1990, the tax per pack was increased to 20.0 cents on January 1, 1991, and then to 24.0 cents on January 1, 1993. Finally, as a result of the 1998 budget agreement, federal cigarette excise taxes are scheduled to rise by 10 cents per pack in 2000 and by an additional 5 cents per pack in 2002.

Also as part of the Consolidated Omnibus Budget Reconciliation Act of 1985, taxes of 8.0, 24.0, and 45.0 cents per pound were imposed on chewing tobacco, snuff, and pipe tobacco, respectively. These were the first new federal taxes on chewing tobacco and snuff since 1965, when the taxation was set at 10 cents per pound. These taxes are currently 12.0, 36.0, and 67.5 cents per pound (Table 6.11). This assessment amounts to approximately 2.7 cents per 1.2-ounce can of snuff, 2.3 cents per 3-ounce pouch of chewing tobacco, and 6.3 cents per 1.5-ounce pouch of pipe tobacco. Tobacco for roll-your-own cigarettes is not taxed at the federal level.

State and Local Tobacco Taxes

All 50 states and the District of Columbia currently impose excise taxes on cigarettes. The first of these was a tax levied by Iowa in 1921. It was followed in 1923 by taxes in Georgia, South Carolina, South Dakota, and Utah. On October 1, 1969, North Carolina became the last state to impose a tax on cigarettes. As of May 1, 2000, these taxes ranged from 2.5 cents per pack in Virginia to $1.11 per pack in New York (Table 6.12). Forty-four states currently impose taxes on tobacco products other than cigarettes (Table 6.13); only 17 states imposed such taxes in 1964. In general, these other taxes are ad valorem taxes. The general sales tax in most states applies to cigarettes and other tobacco products, with the tax base in most states including the excise tax. As of November 1, 1999, these sales taxes added 8–25 cents per pack to the price of cigarettes (Table 6.12). In eight states, 450 cities and counties impose additional taxes on the sale of cigarettes, and 85 of these also tax other tobacco products. The largest of the local cigarette taxes are those imposed in Chicago (combined county and city taxes of 34 cents per pack) and New York City (8 cents per pack).

At least until the 1950s, state taxes on cigarettes were enacted and raised to generate revenues rather than to discourage consumption. The average year such taxes were initiated in the six major tobacco-producing states (1939) slightly predates the average year for the other states (1940) (Warner 1981). Before the widespread publicity on the health consequences of smoking, the average tax rate in the six tobacco states was only slightly lower than that in the other states

(2.5 vs. 2.9 cents per pack). Since the release in the mid-1950s of the first reports describing the adverse health effects of cigarette smoking, and even more so since the 1964 release of the initial Surgeon General's report on smoking and health, state governments have actively used cigarette taxes as a principal tool in their campaigns to reduce tobacco use. For example, the number of tax increases has risen from an average of less than three per year in the early 1950s to an average of more than eight per year in the late 1950s, and a record 22 states increased their cigarette taxes in 1965 (Table 6.14). Similar activity occurred during 1967–1970, when antismoking ads were broadcast under the Fairness Doctrine and after cigarette advertising on television and radio was banned in 1971. The once-negligible difference in cigarette excise tax rates between the tobacco-producing states and other states grew substantially over this period. By May 1, 2000, the simple average of cigarette taxes in the six largest tobacco-growing states was 7.1 cents compared with 46.5 cents in the remaining states and the District of Columbia.

The use of increased cigarette and other tobacco taxes to discourage all tobacco use was even more obvious in the late 1980s and early 1990s. In November 1988, California voters approved the Tobacco Tax and Health Protection Act (Proposition 99), the then-largest single increase (25 cents per pack) in any state excise tax on cigarettes. New taxes were also imposed on other forms of tobacco. The novel feature of this tax hike was that 20 percent of the new revenues generated by the tax increase was earmarked for tobacco-related education activities and 5 percent was allocated to tobacco-related research.

The success of Proposition 99 in California led to a similar voter-approved measure in Massachusetts. In November 1992, voters passed Question 1, which raised the state cigarette tax from 26 cents to 51 cents per pack and increased the state tax on chewing

Table 6.10. Federal cigarette excise taxes, selected dates, 1864–2002

Effective date	Tax per pack of 20 cigarettes (cents)
June 30, 1864*	0.8, 2.4
April 1, 1865†	2.4, 4.0
August 1, 1866‡	4.0, 8.0, 8.0+20%
March 2, 1867	10.0
July 20, 1868	3.0
March 3, 1875	3.5
March 3, 1883	1.0
August 15, 1897	2.0
June 14, 1898	3.0
July 1, 1901§	1.08, 2.16
July 1, 1910	2.5
October 4, 1917	4.1
February 25, 1919	6.0
July 1, 1940	6.5
November 1, 1942	7.0
November 1, 1951	8.0
January 1, 1983	16.0
January 1, 1991	20.0
January 1, 1993	24.0
January 1, 2000	34.0
January 1, 2002Δ	39.0

*Lower rate applied to cigarettes valued at $6 or less per 100 packs of 25 each.
†Lower rate applied to cigarettes valued at $5 or less per 100 packs of 25 each.
‡Lower rate applied to cigarettes valued at $8 or less per 1,000. Higher rate applied to cigarettes valued at more than $12 per 1,000.
§Lower rate applied to cigarettes valued at $2 or less per 1,000.
ΔScheduled.
Source: Orzechowski and Walker 2000.

Table 6.11. Federal excise tax rates (cents/pound) on chewing tobacco, snuff, and pipe tobacco, selected years, 1986–2002

Year	Chewing tobacco	Snuff	Pipe tobacco
1986	8.0	24.0	45.0
1991	10.0	30.0	56.25
1993	12.0	36.0	67.5
2000	17.0	51.0	95.67
2002*	19.5	58.5	109.69

*Scheduled.
Sources: Advisory Commission on Intergovernmental Relations 1991; Bureau of Alcohol, Tobacco and Firearms 2000.

Table 6.12. State cigarette excise taxes and sales taxes (cents/pack) applied to cigarettes

State	Excise tax rate May 1, 2000	Sales tax November 1, 1999	State	Excise tax rate May 1, 2000	Sales tax November 1, 1999
Alabama	16.5	11.0	Montana	18.0	0
Alaska	100.0	0	Nebraska	34.0	13.0
Arizona	58.0	16.0	Nevada	35.0	20.0
Arkansas	31.5*	13.0	New Hampshire	52.0	0
California	87.0	25.0	New Jersey	80.0	17.0
Colorado	20.0	0	New Mexico	21.0	14.0
Connecticut	50.0	19.0	New York	111.0	13.0
Delaware	24.0	0	North Carolina	5.0	10.0
District of Columbia	65.0	19.0	North Dakota	44.0	18.0
Florida	33.9	17.0	Ohio	24.0	13.0
Georgia	12.0	8.0	Oklahoma	23.0	12.0
Hawaii	100.0	15.0	Oregon	68.0	0
Idaho	28.0	14.0	Pennsylvania	31.0	17.0
Illinois	58.0	20.0	Rhode Island	71.0	23.0
Indiana	15.5	13.0	South Carolina	7.0	13.0
Iowa	36.0	14.0	South Dakota	33.0	11.0
Kansas	24.0	13.0	Tennessee	13.0	21.0
Kentucky	3.0	15.0	Texas	41.0	18.0
Louisiana	20.0	11.0	Utah	51.5	15.0
Maine	74.0	18.0	Vermont	44.0	15.0
Maryland	66.0	16.0	Virginia	2.5	11.0
Massachusetts	76.0	18.0	Washington	82.5	23.0
Michigan	75.0	20.0	West Virginia	17.0	15.0
Minnesota	48.0	19.0	Wisconsin	59.0	16.0
Mississippi	18.0	19.0	Wyoming	12.0	11.0
Missouri	17.0	11.0			

*Arkansas tax can rise to 34 cents if the state does not appropriate adequate funds for breast cancer research and control.

Sources: Orzechowski and Walker 2000; Centers for Disease Control and Prevention, Office on Smoking and Health, State Tobacco Activities Tracking and Evaluation System, unpublished data.

tobacco by 25 percent. Although Massachusetts law prevents funds raised by the tax from being earmarked for tobacco-related education and prevention efforts, the funds are placed into a Health Protection Fund, and the wording of the approved measure strongly recommended that at least part of the funds be all cated to activities related to reducing tobacco use.

More recently, Michigan voters in 1994 enacte Proposal A, which changed the financing for Mich gan public schools. Part of this plan included raisi

the general state sales tax (which is applied to cigarettes and other tobacco products) from 4 to 6 percent and tripling the state excise tax on cigarettes to 75 cents per pack, representing the largest single increase in cigarette taxes ever implemented in the United States. New taxes were also imposed on various other tobacco products. Six percent of the new revenues were earmarked for health improvement activities, including tobacco-related education and prevention efforts.

In November 1994, Arizona voters approved the Tobacco Tax and Health Care Act, which included a 40-cent increase in the state cigarette tax with earmarking provisions similar to those in California, Massachusetts, and Michigan. At the same time, however, voters in Colorado rejected a tax hike of 50 cents per pack with similar features. In November 1996, Oregon voters approved Measure 44, which increased cigarette taxes by 30 cents per pack, raised the tax on other tobacco products from 35 to 65 percent of wholesale price, and dedicated a portion of the increased revenue to tobacco use prevention and education. Similar large cigarette-tax increases, including some that dedicate significant funds to tobacco control activities, have been recently legislated in a number of states, including Alaska, Maine, New Jersey, and New York. In addition, in 1998, voters in California approved an additional 50-cent per pack increase in the state cigarette tax.

The relative ease with which cigarettes and other tobacco products can be transported and the potential profits from illegal activity of this kind have limited state and local governments' ability to further raise tobacco taxes. The large disparities in price resulting from differences in tobacco taxation create incentives to (1) smuggle on a casual level (involving small quantities for personal use) or on an organized level (involving large quantities, generally for resale); (2) purchase cigarettes through tax-free outlets, including military stores and American Indian reservations; and (3) illegally divert cigarettes within the usual distribution system by forging tax stamps, which results in underreporting. Altogether, this "butt legging" (ACIR 1977) can result in a net loss of revenues when tobacco taxes are increased.

Although casual smuggling has always been a problem, states reported that organized smuggling activities rose significantly after the cigarette tax hikes of the late 1960s. In response to state pressure, the Trafficking in Contraband Cigarettes Act of 1978 (Public Law 95-575) was enacted. This act, which dealt only with the organized smuggling of cigarettes, prohibited the single-transaction transport, receipt, shipment, possession, distribution, or purchase of more than 60,000 cigarettes not bearing the tax indicia of the state in which the cigarettes were initially sold. The ACIR (1985) suggests that the law was even more effective than its proponents predicted. Casual smuggling, however, may become a more significant problem as the differences between cigarette taxes in neighboring states increase as the result of some of the recent large tax hikes in some states.

Several econometric analyses of cigarette demand have carefully considered the effects of price differentials on organized and casual cigarette smuggling on state cigarette sales (Baltagi and Levin 1986, 1992; Chaloupka and Saffer 1992; Becker et al. 1994; Saba et al. 1995; Jackson and Saba 1997; Yurekli and Zhang 2000). In general, these studies concluded that smuggling has a significant, but small, impact on cigarette demand, implying that a state cigarette tax increase will lead to some smuggling. Yurekli and Zhang (2000), for example, estimate that, on average, 6 percent of state cigarette tax revenues were lost due to smuggling activities in 1995. However, given the magnitude of these estimates, Merriman (1994) and Baltagi and Levin (1992) estimated that state cigarette taxes are below their revenue-maximizing levels. Thus, states can raise cigarette taxes and generate increased revenues, even as cigarette sales decline and interstate smuggling increases.

Cigarette Taxes and Cigarette Prices

Increases in cigarette and other tobacco taxes result in higher prices for these products. Most cigarette taxes, however, are excise taxes; unless they are increased regularly over time, the value of the tax will fall in real terms (after analysis accounts for the effects that inflation, as measured by the Consumer Price Index, has on the tax). Because taxes are an important component of price, one of the consequences of an excise tax system with relatively infrequent increases is that, at least during the period between excise tax increases, the real price of cigarettes will fall over time as the prices of other goods and services increase more rapidly.

When trends are examined in real cigarette prices over the past four decades, three clear periods are observed (Table 6.15). The first is 1955–1971, when states were increasing taxes not only to raise revenues but also to discourage smoking. The real value of state taxes during this period approximately doubled from 13.1 cents (1982–1984 dollars) to 26.4 cents per pack. This increase was more than sufficient to offset the reductions in the real federal tax (from 29.9 cents to 19.8

Table 6.13. State tax rates on tobacco products other than cigarettes as of January 1, 2000

State	Taxes on other tobacco products
Alabama	Cigars retailing for: a) ≤3.5 cents each or less, $150 per thousand; b) >3.5 and ≤5 cents each, $3.00 per thousand; c) >5 and ≤8 cents each, $4.50 per thousand; d) >8 and ≤10 cents each, $7.50 per thousand; e) >10 and ≤20 cents each, $15 per thousand; f) >20 cents each, $20.25 per thousand. Little cigars: 2 cents for each 10 or fraction thereof. Smoking tobacco: a) ≤1.125 ounces, 2 cents; b) >0.125 ounces and ≤2 ounces, 5 cents; c) >2 ounces and ≤3 ounces, 8 cents; d) >3 ounces and ≤4 ounces, 11 cents; e) 3 cents additional tax for each ounce or fraction part thereof over 4 ounces. Chewing tobacco: 0.75 cents of each ounce or fraction thereof. Snuff: a) ≤0.625 ounces, 0.5 cents; b) >0.625 ounces, and ≤1.625 ounces, 1 cent; c) >1.625 ounces and ≤2.5 ounces, 2 cents; d) >2.5 ounces and ≤3 ounces, 2.5 cents; e) >3 ounces and ≤5 ounces (cans, packages, gullets), 3 cents; f) >3 ounces and ≤5 ounces (glasses, tumblers, bottles), 3.5 cents; g) >5 ounces and ≤6 ounces, 4 cents; h) 1 cent additional tax for each ounce or fraction thereof over 6 ounces.
Alaska	75% of wholesale price.
Arizona	Cigars retailing for: a) ≤5 cents, 6.4 cents for each 3 cigars; b) >5 cents, 6.4 cents each. Little cigars: 12.9 cents for each 20 or fraction thereof. Smoking and chewing tobacco and snuff: 6.5 cents per ounce or major fraction thereof. Plug tobacco: 1.6 cents per ounce or fraction thereof.
Arkansas	23% of manufacturers' invoice price.
California*	61.56% of wholesale price.†
Colorado	20% of manufacturers' price.
Connecticut*	20% of manufacturers' price.
Delaware	15% of wholesale price.
District of Columbia	None.

*Little cigars taxed at the same rate as cigarettes.
†California rate reset at beginning of each fiscal year; New Hampshire rate reset semiannually.
‡Maryland tax becomes effective July 1, 2000.
Sources: Orzechowski and Walker 2000; Centers for Disease Control and Prevention, Office on Smoking and Health, State Tobacco Activities Tracking and Evaluation System, unpublished data.

Table 6.13. Continued

State	Taxes on other tobacco products
Florida	Smoking tobacco, chewing tobacco, and snuff: 25% of wholesale price.
Georgia	Little cigars: weighing ≤3 pounds per 1,000, 2 mills each. All other cigars: 13% of wholesale price.
Hawaii	40% of wholesale price.
Idaho	40% of wholesale sales price.
Illinois	18% of wholesale price.
Indiana	15% of wholesale price.
Iowa*	22% of wholesale price.
Kansas	10% of original invoice price from the manufacturer to the wholesaler.
Kentucky	None.
Louisiana	Cigars: a) a list price of $120 per thousand or less, tax is 8% of net invoice price; b) a list price of over $120 per thousand, tax is 20% of net invoice price. Smoking tobacco: 33% of net invoice price.
Maine*	Chewing tobacco and snuff: 62% of wholesale sales price. Cigars and smoking tobacco: 16% of wholesale sales price.
Maryland‡	All other products 15% of wholesale price.
Massachusetts	75% of wholesale price for smokeless tobacco products. 15% of wholesale price for cigars and pipe tobacco.
Michigan	16% of wholesale price.
Minnesota	35% of wholesale price.
Mississippi	15% of manufacturers' list price.
Missouri	10% of manufacturers' price.
Montana	12.5% of wholesale price.
Nebraska	15% of wholesale price.
Nevada	30% of wholesale price.
New Hampshire†	Chewing tobacco and snuff: 17.9% of wholesale price invoiced to retailer.
New Jersey	48% of wholesale price.
New Mexico	25% of product value.
New York	20% of wholesale price.
North Carolina	2% of wholesale price.
North Dakota	28% of wholesale price.
Ohio	17% of wholesale price.
Oklahoma	Cigars, cheroots, stogies, etc., weighing >3 pounds per thousand retailing for: a) ≤4 cents each, $10 per thousand; b) >4 cents each, $30 per thousand. Little cigars: 9 mills each. Smoking tobacco: 40% of factory list price. Chewing tobacco and snuff: 30% of factory list price.

Table 6.13. Continued

State	Taxes on other tobacco products
Oregon*	65% of wholesale sales price.
Pennsylvania	None.
Rhode Island	20% of wholesale price.
South Carolina	Cigars, cheroots, stogies, etc., retailing for: a) ≤5 cents each, $11 per thousand; b) >5 cents each, $20 per thousand. Little cigars: 2 cents for each 8 or fraction thereof. Smoking tobacco: 36% of manufacturers' price. Chewing tobacco and snuff: 5% of manufacturers' price.
South Dakota	10% of wholesale price.
Tennessee*	6% of wholesale price.
Texas	Cigars: Tax on cigars and tobacco is based on weight per 1,000 and retail selling price. a) ≥3 pounds per 1,000, 1 cent for each 10 cigars; b) >3 pounds per 1,000 and retailing for ≤3.3 cents each, $7.50 per 1,000; c) >3 pounds per 1,000, retailing for >3.3 cents each and containing a substantial amount of nontobacco ingredients, $11 per thousand; d) >3 pounds per 1,000, retailing for >3.3 cents each and containing a substantial amount of nontobacco ingredients, $15 per thousand; e) Chewing, pipe, or smoking tobacco, and snuff: 35.213% of the manufacturers' list price exclusive of any trade discount, special discount, or deal.
Utah	35% of manufacturers' selling price delivered into state.
Vermont	41% of distributors' price.
Virginia	None.
Washington	74.9% of wholesale price.
West Virginia	None.
Wisconsin	20% of wholesale price.
Wyoming	All other products 20% of wholesale price.

cents per pack); as a result, cigarette taxes continued to account for about 50 percent of cigarette prices.

During the 1970s, however, the real price of cigarettes dropped significantly because of the stability of cigarette excise taxes and the relatively rapid increases in the prices of other goods and services. During this period, the real value of the federal cigarette tax (which was unchanged in nominal terms) fell by more than 50 percent, and the real value of state taxes dropped by nearly as much. The net result was a decline of 38.5 percent in the real price of cigarettes. Moreover, during this period, taxes as a share of cigarette prices fell from 46.8 to 33.1 percent, because the nontax component of real price was relatively stable.

Since 1981, however, the real price of cigarettes has increased sharply, from 69.3 cents to 127.1 cents per pack in November 1992, and further in early 1993. Important factors behind this increase were the federal tax increases in 1983, 1991, and 1993, which tripled the nominal value of the cigarette excise tax. Also important was the steady rise in the real value of average state excise taxes on cigarettes, from a low of

Table 6.14. Number of increases and decreases in state excise taxes on cigarettes, July 1, 1950–May 1, 2000

Year	Increases (Decreases)	Year	Increases (Decreases)
1950	2	1976	1
1951	7 (1)	1977	4
1952	0	1978	1 (1)
1953	2	1979	4
1954	3	1980	2
1955	11	1981	6 (1)
1956	5 (1)	1982	10
1957	8	1983	13
1958	4	1984	4
1959	15	1985	11
1960	4 (2)	1986	6
1961	17 (1)	1987	13
1962	2	1988	3
1963	15	1989	14 (1)
1964	5	1990	8
1965	22	1991	13 (1)
1966	4 (1)	1992	7
1967	12	1993	15 (2)
1968	8	1994	8
1969	20	1995	5
1970	7	1996	2
1971	16	1997	9
1972	5	1998	2
1973	2	1999	3
1974	2	2000	1
1975	5		

Sources: Orzechowski and Walker 2000; Centers for Disease Control and Prevention, Office on Smoking and Health, State Tobacco Activities Tracking and Evaluation System, unpublished data.

14.0 cents per pack in 1982 to 19.4 cents per pack in 1993. However, even with the increases in the real values of the federal and state taxes on cigarettes, taxes as a share of price fell substantially from 1981 to 1993 (from 33.1 to 24.9 percent). The most important factor behind the rise in real cigarette prices, then, was the sharp rise in nontax (i.e., manufacturer-added) price components. In 1981, the real value of the nontax portion of average cigarette prices was 46 cents. By 1993, this amount was 79.5 cents, which is an increase of more than 70 percent. As described earlier in this chapter, in "High Tobacco Concentration and the Impact of Prevention Policies," much of this increase was attributable to the less than perfectly competitive supply side of the cigarette market. The result of the increases in both the tax and the nontax components of cigarette prices was an increase of almost 85 percent in the real price of cigarettes from 1981 to 1993.

Real cigarette prices declined sharply as a result of "Marlboro Friday" in April 1993, when wholesale cigarette prices, first for Marlboro then soon after for other premium brands, were cut by 25 percent. More recently, however, real cigarette prices have risen significantly. These increases are partly the result of increases in state and federal cigarette excise taxes over the past few years. More important, however, are the significant increases in wholesale cigarette prices beginning in 1997. These prices increased by more than 12 percent between March 1997 and April 1998, returning to their 1992 nominal level (USDA 1998a), in part the result of increased costs associated with tobacco industry settlements with Mississippi, Florida, Texas, and Minnesota. Wholesale prices increased an additional 45 cents per pack in November 1998, on the day the Master Settlement Agreement was announced. This increase, the largest in history, was followed nine months later by an additional 18-cent per pack increase (USDA 2000).

International Tobacco Taxes

Among industrialized countries around the world, the United States has one of the lowest average prices and taxes on cigarettes (Table 6.16). As of December 31, 1996, the average tax in the United States was 66.0 cents per pack, well below the taxes imposed in almost every other industrialized country. At that time, taxes in various other countries, in U.S. dollars, ranged from $5.23 per pack in Norway to 47 cents per pack in South Africa. Most developed countries have at least double the average tax in the United States. Some interesting features of these taxes include earmarking for tobacco-related education and other health-related activities (in Denmark, Finland, Iceland, Peru, and elsewhere), the creation of state-based Health Promotion Foundations in Australia and the Health Sponsorship Council in New Zealand to fund sporting and artistic

Table 6.15. Cigarette taxes and cigarette prices, 1955–2000 (cents/pack)

Year	Weighted average state tax*†	Average federal tax†	Average cigarette price‡	Taxes as a percentage of average price§	Real average state tax†Δ	Real average federal tax†Δ	Real average cigarette priceΔ
1955	3.5	8.0	22.7	48.7	13.1	29.9	84.7
1956	3.8	8.0	23.2	47.4	14.0	29.4	85.3
1957	3.9	8.0	23.8	48.8	13.9	28.5	84.7
1958	4.0	8.0	25.0	48.0	13.8	27.7	86.5
1959	4.2	8.0	25.6	46.6	14.4	27.5	88.0
1960	4.7	8.0	26.1	48.9	15.9	27.0	88.2
1961	4.7	8.0	26.1	48.6	15.7	26.8	87.3
1962	5.1	8.0	26.9	48.3	16.9	26.5	89.1
1963	5.2	8.0	26.8	49.4	17.0	26.1	87.6
1964	5.6	8.0	27.9	49.3	18.1	25.8	90.0
1965	5.9	8.0	28.2	49.8	18.7	25.4	89.5
1966	6.9	8.0	30.0	51.4	21.3	24.7	92.6
1967	7.1	8.0	30.5	50.8	21.3	24.0	91.3
1968	8.4	8.0	32.3	49.2	24.1	23.0	92.8
1969	9.1	8.0	32.8	48.9	24.8	21.8	89.4
1970	10.2	8.0	37.1	47.7	26.3	20.6	95.6
1971	10.7	8.0	38.9	46.8	26.4	19.8	96.0
1972	11.6	8.0	40.0	47.7	27.8	19.1	95.7
1973	12.1	8.0	40.3	48.4	27.3	18.0	90.8
1974	12.1	8.0	41.8	47.6	24.5	16.2	84.8

*State taxes are an average of taxes in all taxing states (42 in 1955; 50 in 1970 and thereafter) and the District of Columbia, weighted by tax-paid cigarette sales in those states.
†Nominal and real average state and federal tax data are for the fiscal year ending June 30.
‡Price reflects the median retail price for cigarettes (including generic brands) in all taxing states, generally as of November 1 of the state fiscal year.
§Percentages cannot be calculated directly from the tax and price information, because taxes are weighted average taxes for the entire fiscal year, whereas prices and percentages are generally as of November 1.
ΔReal cigarette taxes and prices are obtained by dividing the nominal taxes and prices by the national Consumer Price Index; the average of 1982–1984 is the benchmark.
¶Preliminary estimate.
Source: Orzechowski and Walker 2000.

events previously backed by the tobacco industry, and the differential taxes on cigarettes with high-tar and high-nicotine content used in previous years in the United Kingdom (Roemer 1993).

One consequence of the differences in cigarette taxes and prices across countries is the potential for casual and organized cigarette smuggling and other forms of tax evasion. The cigarette industry, for example, frequently argues that cigarette tax increases

Table 6.15. Continued

Year	Weighted average state tax*†	Average federal tax†	Average cigarette price‡	Taxes as a percentage of average price§	Real average state tax†Δ	Real average federal tax†Δ	Real average cigarette price Δ
1975	12.2	8.0	44.5	44.5	22.7	14.9	82.7
1976	12.4	8.0	47.9	41.4	21.8	14.1	84.2
1977	12.5	8.0	49.2	40.5	20.6	13.2	81.2
1978	12.9	8.0	54.3	37.1	19.8	12.3	83.3
1979	12.9	8.0	56.8	35.5	17.8	11.0	78.2
1980	13.1	8.0	60.0	34.5	15.9	9.7	72.8
1981	13.2	8.0	63.0	33.1	14.5	8.8	69.3
1982	13.5	8.0	69.7	29.9	14.0	8.3	72.2
1983	14.7	12.0	81.9	26.8	14.8	12.0	82.2
1984	15.3	16.0	94.7	33.2	14.7	15.4	91.1
1985	15.9	16.0	97.8	32.3	14.8	14.9	90.9
1986	16.2	16.0	104.5	30.8	14.8	14.6	95.3
1987	16.9	16.0	110.0	29.9	14.9	14.1	96.8
1988	18.2	16.0	122.2	28.1	15.4	13.5	103.3
1989	21.8	16.0	127.5	26.5	17.6	12.9	102.8
1990	24.7	16.0	144.1	26.4	18.9	12.2	110.3
1991	25.9	16.0	153.3	25.6	19.0	11.7	112.6
1992	26.5	20.0	173.5	25.6	18.9	14.3	123.7
1993	28.0	22.0	183.7	24.9	19.4	15.2	127.1
1994	31.5	24.0	169.3	31.4	21.3	16.2	114.2
1995	31.2	24.0	175.8	31.0	20.5	15.7	115.4
1996	31.7	24.0	179.6	31.6	20.2	15.3	114.5
1997	31.8	24.0	185.4	30.5	19.8	15.0	115.5
1998	34.1	24.0	195.0	31.5	20.9	14.7	119.6
1999	36.4	24.0	217.5	28.2	21.8	14.4	130.6
2000	39.8¶	29.0¶	292.6	22.1	23.2¶	16.9¶	170.5¶

will actually lead to reductions in tax revenues due to smuggling and other tax evasion (British-American Tobacco Company Limited 1994). The smuggling problem is exacerbated by the relative ease with which tobacco products can be transported, the potential profits from this illegal activity, the presence of corruption and organized crime, the widespread street selling, the availability of tax-free and duty-free cigarettes, and the nonexistent or relatively weak policies concerning cigarette smuggling and their lack of enforcement (ACIR 1977, 1985; Joossens and Raw 1995; Joossens et al., in press). Joossens and Raw (1995, 1998) argued that many of these other factors can be as important as price differences in spawning cigarette smuggling. For example, they noted that there is little evidence of smuggling in some of the highest priced European

Table 6.16. Average retail cigarette price and total taxes per pack (U.S. dollars/pack), selected countries, December 31, 1996

Country	Average retail price	Total taxes	Tax as a percentage of retail price*
Norway	7.05	5.23	74
United Kingdom	5.27	4.30	82
Ireland	4.94	4.16	84
Denmark	4.75	4.02	85
Finland	4.54	3.48	77
Australia	4.50	2.92	65
Sweden	4.47	3.13	70
New Zealand	4.17	2.79	66
Canada (highest provincial taxes)	4.09	2.97	73
Singapore	3.72	1.87	50
Hong Kong	3.62	1.76	49
France	3.47	2.61	75
Belgium	3.23	2.39	74
Germany	3.18	2.28	72
Canada (average provincial taxes)	3.00	1.97	66
Austria	2.84	2.11	74
Netherlands	2.66	1.94	73
United States (highest state taxes)	2.65	1.24	47
Italy	2.17	1.59	73
Canada (lowest provincial taxes)	2.02	1.12	55
United States (average state taxes)	1.90	0.66	35
Greece	1.82	1.33	73
Portugal	1.77	1.43	81
United States (lowest state taxes)	1.60	0.34	21
Thailand	1.58	0.89	56
Taiwan	1.45	0.62	43
Brazil	1.43	1.06	74
Spain	1.08	0.81	75
South Africa	1.04	0.47	45

Notes: (a) Figures given are for a package of 20 of the most popular price category; (b) exchange rates are from the Bank of Canada Official Exchange Rates as of December 31, 1996.
*The tax as a percentage of retail price refers to the portion of the average retail selling price that composes all applicable taxes and other fees imposed on the product.
Source: Smoking and Health Action Foundation (Canada), unpublished data, April 30, 1997.

countries, including France, Norway, Sweden, and the United Kingdom, whereas there is extensive evidence of smuggling in countries with relatively low prices, such as Spain and Italy. Merriman and colleagues (in press) provide empirical evidence that the perceived level of corruption explains more of the variance in experts' estimates of the magnitude of cigarette smuggling than do cigarette prices. Moreover, Joossens and colleagues (Joossens and Raw 1998; Joossens et al., in press) concluded that much of the smuggling that does occur in Europe and elsewhere is encouraged by multinational tobacco companies. Thursby and Thursby (1994) provided empirical support for this argument, based on their analysis of data from the United States from which they concluded that increases in federal cigarette excise taxes lead to increased commercial cigarette smuggling.

Perhaps the most interesting international comparison is between cigarette tax policy in the United States and Canada. In 1970, average taxes (including sales taxes) on cigarettes were 30 cents per pack in Canada and 20 cents per pack in the United States. By 1980, the average Canadian tax, 46 cents per pack, was double the U.S. tax. Real prices in both countries had fallen sharply throughout the 1970s, but after 1980, the gap between the two countries widened rapidly. One main reason for this change was the adoption of an ad valorem tax by the federal and provincial governments in Canada. As a result, cigarette taxes in Canada doubled between 1980 and 1984, leading to a 25-percent increase in real cigarette prices. In response to pressure from the cigarette industry, however, the ad valorem tax structure was replaced with an excise tax system in 1984.

The growth in Canadian taxes slowed over the next few years. Most taxing took place at the provincial rather than the federal level. In 1988, however, the Canadian federal government committed to an aggressive campaign to reduce tobacco use; highlighting the campaign was a ban enacted that year on tobacco advertising. In 1989, the federal tax was raised by 2 cents per cigarette, and another hike of 3 cents per cigarette occurred in 1991. At the same time, provincial taxes were increasing rapidly. By early 1994, the average tax per pack of cigarettes was $2.96 (in U.S. dollars), which is more than five times the average U.S. tax.

The large disparities in Canadian and U.S. cigarette prices led to substantial smuggling, which was enabled by the long stretches of unmonitored border between Canada and the United States, the relatively weak border controls, and the high concentration of the Canadian population near U.S. borders (Sweanor and Martial 1994). Much of the black market trade that resulted was in Canadian-produced cigarettes that had been exported to the United States (exports were not subject to the Canadian taxes) and then smuggled back into Canada. Relatively little black market trade involved cigarettes produced in the United States; U.S. cigarettes use a blend of tobacco different from Canadian cigarettes and are less desired by Canadian smokers (Sweanor and Martial 1994). In a short-lived effort to reduce the smuggling problem, a tax of 80 cents per pack was applied to Canadian cigarette exports in mid-February 1992. This tax was repealed six weeks later, although preliminary evidence indicated that it had been successful in reducing smuggling (Sweanor and Martial 1994). After the repeal of the export tax, Canadian cigarette exports to the United States rose dramatically, and smuggling increased again.

In response to an aggressive industry-sponsored campaign, the federal tax on cigarettes in Canada was reduced by $5.00 per carton on February 9, 1994. Moreover, the federal government agreed to match provincial reductions in taxes up to an additional $10.00 per carton. Quebec immediately lowered its provincial tax by $11.00 per carton for a total tax cut of $26.00 per carton, leading to a 50-percent drop in price. By August 1994, four other provinces had reduced cigarette taxes substantially. These cuts reduced the average Canadian tax per pack from $2.96 before the federal tax cut to $1.97 as of December 31, 1996 (in U.S. dollars), which was an amount still well above the average U.S. cigarette tax of 66 cents per pack at that time.

The Canadian experience was cited by the tobacco industry during the recent debates over the proposed national tobacco settlement as evidence that a black market in cigarettes would develop in the United States in response to large cigarette tax increases. However, there is little evidence to support this contention. Given that Canadian cigarette taxes were reduced because of smuggling from the United States, it is likely that these taxes would be increased if the United States were to adopt large tax increases, making it unlikely that widespread smuggling of cigarettes from Canada into the United States would occur. Cigarette prices in Mexico, however, are well below those in the United States, and large increases in U.S. prices could make smuggling cigarettes from Mexico a highly profitable venture. To date, however, no empirical evidence supports the contention of significant smuggling of cigarettes from Mexico into the United States. Furthermore, unlike the U.S.-Canadian border, the border between the United States and Mexico is relatively short and heavily guarded, making it much more difficult to smuggle large quantities of a bulky product like cigarettes.

Finally, several relatively easy options exist for limiting cigarette smuggling (Joossens and van der Merwe 1997; Joossens et al., in press). These include prominent tax-paid markings on all tobacco products and sizable increases in the penalties for cigarette smuggling. The ACIR (1985), for example, concluded that the Trafficking in Contraband Cigarettes Act (Public Law 95-575), which prohibited the transportation, receipt, shipment, possession, distribution, or purchase of large quantities of cigarettes that did not bear the tax indicia of the state in which the cigarettes are found, led to a significant reduction in interstate cigarette smuggling resulting from interstate price differentials.

Discussion

If one applies Cook and Moore's (1993) discussion of alcohol taxes to cigarette taxes, a provocative question arises when one compares previous cigarette excise taxes with current ones: why is the current tax rate deemed appropriate when it is just over one-half the level that was deemed appropriate in 1951? Unless it is in the public interest to tax cigarettes at a much lower rate now than then (an odd notion, given that in 1951 much less evidence was available on the health hazards of smoking), a case can be made for restoring taxes to their earlier levels. Similar arguments can be made at the state level, particularly in those states where taxes have not changed or have been increased modestly and infrequently over time.

Other, comparative standards for appropriate taxes could be used. For example, as shown in Table 6.12, state excise taxes on cigarettes differ substantially; these differences reflect several factors, including the importance of tobacco for the local economy. At another level of comparison, large differences between cigarette taxes in Canada and the United States gave rise to a significant black market trade, which in turn resulted in reductions in Canadian taxes. At the global level, cigarette and other tobacco taxes in the United States are among the lowest in industrialized countries around the world. Such comparisons suggest that relatively high taxes may be appropriate in some areas and low taxes appropriate in others. On the other hand, one could argue that the taxes on all tobacco products should be equivalent. This last issue is discussed in greater detail in the next section, "Fairness Standard and Optimal Cigarette Taxes."

Taxes on smokeless tobacco products are much lower than taxes on cigarettes, particularly at the federal level. The limited research suggests that increases in cigarette excise taxes may have reduced cigarette smoking but also may have contributed to an increased use of smokeless tobacco products (Ohsfeldt and Boyle 1994; Ohsfeldt et al. 1997, 1999). Some public health advocates and others have therefore called for the equalization of taxes on tobacco (CSH 1994; U.S. House of Representatives 1994).

Fairness Standard and Optimal Cigarette Taxes

Fair tax policy is an issue that is often debated but difficult to apply when "optimal" taxes of potentially hazardous substances are discussed (Cook and Moore 1993). For taxes on cigarettes and other tobacco products, part of the debate revolves around the perceived health benefits and reductions in social costs associated with higher taxes.

In their analysis of economic interventions to reduce alcohol abuse, Cook and Moore (1993) noted that several criteria can be included to judge fairness by those on both sides of the debate. These criteria include a horizontal equity criterion, which suggests that equals should be treated equally; a vertical equity criterion, which suggests that those with the greatest ability to pay should be taxed more heavily; and a benefit criterion, which suggests that those who receive the greatest benefit from government activities should be taxed more heavily. If the basic notion is accepted that people who are otherwise similar should be taxed differently because one uses more tobacco products than the other (a notion that violates the horizontal equity criterion), then other questions about fairness arise. These include questions concerning the alleged regressivity of the taxes and the external costs of smoking and other tobacco use (Cook and Moore 1993).

Equity, Incidence, and Distribution of the Tobacco Tax Burden

As has been discussed previously, increases in cigarette excise taxes are passed on to consumers through higher cigarette prices. Primarily because of the less than perfectly competitive nature of the cigarette industry, prices have increased by more than recent increases in cigarette taxes. Because consumers will pay at least the full amount of a tax increase in higher cigarette prices, some questions of fairness revolve around the distributional effects of the tax hike. To understand these effects, it is useful to look at the relationship between tobacco use and income (or expenditures). (As Cook and Moore [1993] note, income or expenditures are not the only scale on which fairness can be judged, but they are the most commonly used.)

A 1990 report by the Congressional Budget Office (CBO), which used data from the 1984–1985 Consumer Expenditure Survey, made several observations. For example, expenditures on tobacco products increased with income except for people in the highest income quintile. As a percentage of posttax income, however, spending on tobacco was highest in the lowest income quintile (4.0 percent of posttax income) and fell almost proportionately with increased income. Also, if expenditures on tobacco are considered as a percentage of expenditures on all goods and services, however, the share of tobacco expenditures fell gradually over the first four income quintiles (from 1.6 to 1.1 percent) and dropped sharply only in the top quintile (to 0.7 percent). Thus, the CBO notes, if annual family expenditures are more reflective of lifetime income than annual family income, then expenditures on tobacco are only slightly regressive over income classes. Finally, the CBO noted that younger families spent a higher percentage of income on tobacco products and that their share of spending on tobacco products as a percentage of total expenditures was higher as well.

To examine the distributional impact of cigarette excise tax increases on consumers, the CBO simulated what the effects on expenditures would be were the 1990 federal excise tax on cigarettes (16 cents per pack) doubled. At first glance, the simulated increase appeared to fall most heavily on the lowest income categories, thereby implying that cigarette taxes are regressive. However, when income tax brackets and transfer payments (discussed in the next section, "Estimates of the Costs of Smoking") were indexed to account for the price increases associated with excise tax hikes, lowering individual income taxes and raising transfer payments, the apparent regressivity of the tax was reduced. When looking at the tax increase relative to expenditures rather than income, the CBO concluded that cigarette taxes were approximately proportional rather than regressive. Finally, the CBO noted that the largest share of the simulated tax increase was paid for by families in the third and fourth income quintiles and that the smallest share was paid by families in the lowest income (first and second) quintiles.

All of the CBO estimates were based on measures of current income. Lyon and Schwab (1995) used an alternative approach that used measures of permanent or lifetime income to examine the distributional effects of cigarette and other "sin" taxes. This approach could account for the intertemporal nature of cigarette consumption decisions. The investigators concluded that cigarette excise taxes are as regressive as was implied by studies based on current income.

Although cigarette taxes fall most heavily on lower income groups, two recent studies suggest that increases in cigarette taxes may reduce the perceived regressivity of these taxes. A study using data from the British General Household Survey concluded that people in the lowest income groups were the most responsive to price increases (Townsend et al. 1994). Similar findings have been obtained in the United States using data from 13 of the National Health Interview Surveys conducted from 1976 through 1993 (CDC 1998). The price elasticity of cigarette demand by those at or below the median income was estimated to be approximately 70 percent higher than that for persons above the median. Another study found that less educated persons were more responsive than more educated persons to cigarette price changes (Chaloupka 1991). Given the high correlation between income and education, the three studies implied that increased cigarette taxes would reduce observed differences in smoking among socioeconomic groups (i.e., that smoking prevalence is higher in the lower socioeconomic groups) and would thereby counter the perception that cigarette taxes are regressive. Recent research from developing countries supports the hypothesis that lower income populations are relatively more sensitive to price (Jha and Chaloupka 1999; see Chaloupka et al., in press, for a thorough review). Indeed, while cigarette taxes may fall more heavily on lower income groups, an increase in the cigarette tax, because of the greater price sensitivity of lower income smokers, may actually be progressive. Moreover, given the estimates from these studies, the health benefits resulting from reductions in smoking stimulated by increased cigarette taxes would be disproportionately larger in the lowest income populations.

Finally, as the CBO report pointed out, although the potential regressivity of cigarette taxes is of some concern, the U.S. tax system is a mix of many different taxes. Increased progressivity of other taxes and transfer programs could be used to compensate low income families for the tax increase. The CBO considered three alternative changes—a 5-percent increase in food stamp payments, a 10-percent increase in the earned income tax credit, and a combination of the two—to offset the potential regressivity of an increase in the cigarette excise tax. In each case, the CBO concluded that these changes would spend about 15 percent of the net revenues resulting from the tax increase. A similar idea was implicit in the proposed Health Security Act of 1993, which proposed a federal tax increase of 75 cents per pack to partially finance the provision of health insurance and the expansion of benefits to the uninsured and underinsured, most of whom are

in lower socioeconomic groups. Likewise, several recent proposals for national tobacco legislation contain provisions that would offset the potential regressivity of large increases in cigarette taxes.

Estimates of the Costs of Smoking

An alternative approach to the question of fairness deals with the notion that smokers and other tobacco users impose costs on nonusers. One of these costs is the health consequences for nonsmokers of exposure to ETS. A second is the financial external effect caused by collectively financed programs (e.g., Medicaid and Medicare) where payments in and out are not tied to changes in costs and life expectancy caused by smoking. Thus it can be argued that it would be fair for smokers and other tobacco users to pay for the consequences of their use. Cigarette and other tobacco taxes are one relatively efficient approach for attaining this result. However, to set taxes at a level sufficient to cover the costs of cigarette smoking and other tobacco use requires an estimate of these costs.

All studies of the economic costs of tobacco use have focused on the costs of cigarette smoking. The Office of Technology Assessment (U.S. House of Representatives 1994) has noted that although measuring these costs is an inexact science, three general components are included:

- The direct costs of providing health care services to those persons with smoking-related diseases. Such costs include expenditures for preventing, detecting, diagnosing, and treating smoking-related diseases and medical conditions.

- The indirect morbidity costs associated with lost earnings from work because of smoking-related illness.

- The indirect mortality costs related to the loss of future earnings from premature death from smoking-related causes.

Researchers have tried to estimate the economic costs of cigarette smoking by using data from the United States (Rice et al. 1986; Manning et al. 1989, 1991; Hodgson 1992; CDC 1994; U.S. House of Representatives 1994; Miller et al. 1998, 1999) and elsewhere (see Lightwood et al., in press, for a comprehensive review). In addition, as part of the research resulting from Proposition 99, several recent studies have estimated these costs for California (California Department of Health Services 1992; Rice and Max 1992; Max and Rice 1995).

Most of the estimates of the economic costs of smoking have been prevalence based. That is, they are based on the estimated prevalence of smoking-related illnesses in a given year and on the costs associated with those illnesses. Because of the long lags between smoking initiation and the onset of most smoking-related illnesses, these estimates reflect historical trends in smoking and thus cannot be used to predict the impact of changes in smoking prevention policies except over long periods. However, this approach has been widely used because of its relatively simple methodology and the availability of reliable data (Rice et al. 1986).

Several of the recent estimates of the costs of smoking have been incidence based (Oster et al. 1984; Manning et al. 1989, 1991; Hay 1991; Hodgson 1992). That is, these studies attempt to estimate the average additional costs of smoking over the smoker's lifetime. Cost estimates would differ by the person's age, sex, and level of smoking (i.e., a heavy smoker would have higher lifetime costs than a relatively light smoker with the same characteristics). These estimates of the costs of smoking can be useful for policymakers, who can estimate the change in the costs of smoking associated with a change in smoking behavior resulting from a change in policies to reduce smoking. However, these estimates are sensitive to assumptions about future costs and about issues such as technological change and its diffusion (Hodgson 1988).

Many of the studies of the economic costs of smoking have included notably different direct costs in their computations. For example, most include the costs of hospital and nursing home care, physicians' fees, and medications used to treat smoking-related illnesses. One such study estimated that these costs in 1993 were $50 billion and that 43.3 percent of them were paid through public sources (CDC 1994). However, some studies of direct costs have been limited to the costs associated with lung cancer only, whereas others examined a more comprehensive list of smoking-related illnesses, including cardiovascular disease and chronic obstructive pulmonary disease.

Other more recent studies have sought a broader measure of the direct costs of smoking by comparing the differences between total health care spending by smokers and nonsmokers. The most sophisticated of these recent studies control for other risk factors likely to be correlated with smoking in an effort to isolate the impact of smoking on medical expenditures (Miller et al. 1998, 1999). These recent studies estimated smoking-attributable medical care costs of between $53 billion and $73 billion for 1993, or between 6.5 percent and 11.8 percent of all U.S. health care expenditures.